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JEPSON MANUAL GEOGRAPHIC SUBDIVISION BOUNDARY CHANGES FOR THE KLAMATH AND CASCADE RANGES OF NORTHWESTERN CALIFORNIA AND IMPLICATIONS FOR REGIONAL FLORISTICS

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ABSTRACT

When The Jepson Manual: Higher plants of California was published in 1993, its Geographic Subdivisions of California map included an area of Klamath Ranges geology in its Cascade Ranges subdivision, creating an anomaly with floristic ramifications. We aim to correct that anomaly in this paper. This incorrect designation leads to several issues, including ecologic and geologic inconsistences, and problematic results when conducting floristic analysis in the eastern Klamath Ranges. Botanical field surveys for several recent projects in the eastern Klamath Ranges, newly available digitized data made available online by the Consortium of California Herbaria, and several new taxa recently published from the eastern Klamath Ranges provided means and rationale to make much-needed changes to the Klamath Ranges boundary. Using personal experience, existing ecologic and geologic references, and GIS analysis we revised the Klamath and Cascade Ranges boundaries, provided geographic range updates for over 230 plant taxa, and updated the existing California Geographic Subdivisions descriptions to reflect the boundary revisions. Herein we present the revised map boundary, describe our analysis and results, and provide floristic analysis made possible by the map revisions.

Key Words: Biogeographical range, California Floristic Province, Cascade Ranges, Endemics, Geographic Subdivisions of California, Jepson Flora Project, Jepson Manual, Klamath Ranges.

One of the foundational objectives of providing geographic ranges in a botanical reference is to summarize known occurrence information in a way that allows the user to predict where a particular plant taxon may be expected to occur in nature. Traditionally, most manuals used arbitrary political borders, such as county and state boundaries, to describe geographic range. There are unfortunate consequences of using this approach when the political units used to describe plant distributions are physically and biologically heterogeneous; for instance, a single county in California may include portions of the Coast Ranges, the Central Valley, and the Sierra Nevada. This heterogeneity reduces the predictive power of range descriptions and obfuscates bioregional floristic patterns. When published in 1993, the Jepson Manual: Higher plants of California (TJM) (Hickman 1993) introduced a new system, departing from the common practice of using county boundaries to describe geographic range, by combining natural landscape features such as geology, topography, and vegetation patterns to create geographic units that enhance the effectiveness of geographic data in predicting plant occurrences. The TJM geographic system used a map (Jepson map) influenced by existing well-known sources describing California's floristic patterns (Raven and Axelrod 1978; Küchler 1988) to better portray California's diverse vegetation, resulting from combinations of physical parameters and climate. This system was slightly modified and again used for the second edition of TJM (TJM2) published in 2012 (Baldwin et al. 2012). This system and map is based on a hierarchy beginning with three broadly defined floristic provinces—the California Floristic Province, Great Basin Province, and Desert Province, then 25 subregions, and ending with 35 subdivisions. The Jepson map has become the standard botanical geographic range system for California and has also been widely used as the geographical range standard for other applications (e.g., CalFlora, Consortium of California Herbaria).

Inevitably, geographic range classifications developed for large areas will need periodic revision as new information becomes available, particularly in a biologically and physically diverse state such as California. Even the best classification systems will warrant refinement of areas that have been

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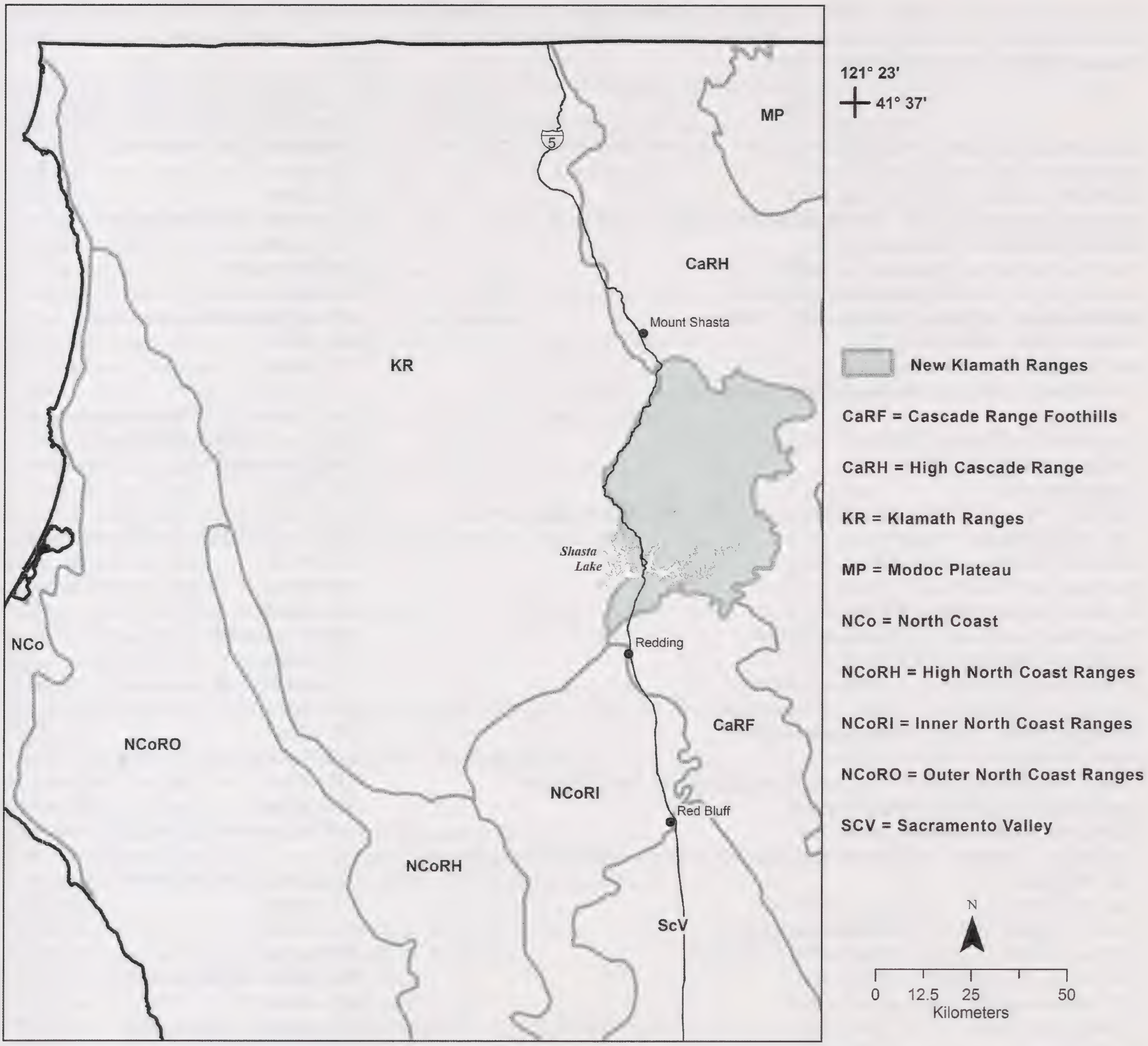

FIG. 1. Portion of the Jepson Map showing the Klamath Ranges, Cascade Ranges, and the new eastern Klamath Range expansion area.

poorly sampled. The Klamath Ranges Subregion (KR), particularly the southeastern Klamath Mountains, represents one such area now deserving refinement. The KR is a geologically old and distinct part of northern California well known for geologic complexity, including many ultramafic substrates and high conifer diversity, with a notable concentration of relict and disjunct conifer species. At its TJM2 eastern boundary the predominantly metamorphic KR meets the volcanic Cascade Ranges (CaR) in an area roughly interpreted by the Jepson map as the Interstate 5 corridor north of Redding, Shasta County, California, to the Oregon border. North of the California-Oregon border, the KR is generally referred to as the Siskiyou Mountains or Siskiyous ecoregion (Meyers et al. 2015).

Unfortunately, this interpretation omits most of the southeastern Klamath Mountains, a significant portion of the KR that is unique in its own right, placing the area instead into the CaR. This interpretation places large areas of limestone and other metasedimentary geology in the CaR, which is inconsistent with the Baldwin et al. (2012) geographic description of this region as "characterized by volcanics." These issues lead to problematic results when conducting floristic analysis in the KR and CaR. For example, the famous Shasta snow-wreath (*Neviusia cliftonii* Shevock, Ertter & D.W. Taylor), as well as Shasta eupatory (*Ageratina shastensis* [D.W. Taylor & Stebbins] R.M. King & H. Rob., and Shasta County arnica (*Arnica venosa* H.M. Hall), all rare KR endemics, have been described in TJM or TJM2 as either entirely or partially occurring in the CaR because of the misinterpreted KR boundary.

Use of the term "Shasta" in the common names of many eastern KR endemics contributes to the

TABLE 1. List of 141 Jepson manual distribution string changes to 114 plant taxa occurring in the revised Klamath Ranges Boundary. CaR = Cascade Ranges; CaRF = Cascade Range Foothills; CaRH = High Cascade Range; KR = Klamath Ranges; eKR = Eastern Klamath Range.

Taxon	Distribution string change
Acmispon grandiflorus (Benth.) Brouillet var. *macranthus* (Greene) Brouillet	KR added; CaR removed
Aconogonon newberryi (Small) Soják	KR added
Adiantum capillus-veneris L.	KR added
Ageratina shastensis (D.W. Taylor & Stebbins) R.M. King & H. Rob.	KR added; CaR removed
Agrostis elliottiana Schult.	KR added
Amorpha californica Nutt. var. *californica*	CaRF removed
Anisocarpus scabridus (Eastw.) B.G. Baldwin	KR added
Anthoxanthum aristatum Boiss. subsp. *aristatum*	KR added; CaRF removed
Anthoxanthum odoratum L.	KR added
Antirrhinum cornutum Benth.	KR added
Antirrhinum vexillocalyculatum Kellogg subsp. *breweri* (A. Gray) D.M. Thomps.	CaRF added; CaRH removed
Aristolochia californica Torr.	CaR made CaRF (CaRH removed)
Arnica venosa H.M. Hall	CaRH removed
Arundo donax L.	KR added
Boechera breweri (S. Watson) Al-Shehbaz subsp. *shastaensis* Windham & Al-Shehbaz	CaR made CaRF (CaRH removed)
Brasenia schreberi J.F. Gmel.	KR added
Brodiaea californica Lindl.	KR added
Brodiaea rosea (Greene) Baker	KR added
Cacaliopsis nardosmia (A. Gray) A. Gray	CaRH removed
Calochortus syntrophus Callahan	KR added
Cardamine pachystigma (S. Watson) Rollins	KR added; CaR removed
Carduus pycnocephalus L. subsp. *pycnocephalus*	KR added
Castilleja affinis Hook. & Arn. subsp. *affinis*	KR added
Ceanothus lemmonii Parry	CaRH added
Ceanothus oliganthus Nutt. var. *sorediatus* (Hook. & Arn.) Hoover	KR added
Centromadia fitchii (A. Gray) Greene	eKR added
Chaenactis suffrutescens A. Gray	CaRH removed
Cheilanthes cooperae D.C. Eaton (*Myriopteris cooperae* ([D.C. Eaton] Grusz & Windham*)*	KR added; CaR removed
Chondrilla juncea L.	KR added
Cicuta douglasii (DC.) J.M. Coult. & Rose	KR added
Clarkia borealis E. Small subsp. *arida* E. Small	eKR added
Crucianella angustifolia L.	KR added; CaRH added
Crypsis schoenoides (L.) Lam.	KR added
Cyperus niger Ruiz & Pav.	KR added; CaRH added
Cypripedium fasciculatum Kellogg ex S. Watson	CaR removed
Delphinium gracilentum Greene	KR added; CaR added
Delphinium variegatum Torr. & A. Gray subsp. *variegatum*	eKR added
Distichlis spicata (L.) Greene	KR added; CaR added
Dittrichia graveolens (L.) Greuter	KR added; CaRF added
Echinochloa colona (L.) Link	eKR added; CaR removed
Eriogonum congdonii (S. Stokes) Reveal	CaRH removed
Eriogonum umbellatum Torr. var. *modocense* (Greene) S. Stokes	KR added
Eriogonum umbellatum Torr. var. *polyanthum* (Benth.) M.E. Jones	KR added
Eriogonum ursinum S. Watson var. *ursinum*	KR added
Eriogonum wrightii Torr. ex Benth. var. *trachygonum* (Torr. ex Benth.) Jeps.	CaR removed
Eriophorum crinigerum (A. Gray) Beetle (*Calliscirpus criniger* [A. Gray] C.N. Gilmour, J.R. Starr & Naczi)	CaR removed
Eriophorum gracile W.D.J. Koch ex Roth	KR added
Erythronium californicum Purdy	CaRH removed
Erythronium multiscapoideum (Kellogg) A. Nelson & P.B. Kenn.	KR added; CaRH added
Eurybia integrifolia (Nutt.) G.L. Nesom	KR added
Festuca trachyphylla (Hack.) Krajina	KR added; CaR added
Fraxinus dipetala Hook. & Arn.	KR added; CaRH added
Fritillaria affinis (Schult. & Schult. f.) Sealy	CaRH removed
Fritillaria eastwoodiae R.M. Macfarlane	KR added
Galium sparsiflorum W. Wight subsp. *glabrius* Dempster & Stebbins	KR added
Genista monspessulana (L.) L.A.S. Johnson	KR added; CaRH added
Glyceria declinata Bréb.	KR added
Grindelia camporum Greene	KR added

TABLE 1. CONTINUED

Taxon	Distribution string change
Heterotheca oregona (Nutt.) Shinners var. *oregona*	CaR removed
Heterotheca oregona (Nutt.) Shinners var. *rudis* (Greene) Semple	CaR removed
Horkelia tridentata Torr. var. *tridentata*	eKR added
Keckiella breviflora (Lindl.) Straw var. *glabrisepala* (D.D. Keck) N.H. Holmgren	CaR added
Lepidium heterophyllum (S. Watson) M.E. Jones	KR added
Lewisia cantelovii J.T. Howell	CaRH removed
Lewisia cotyledon (S. Watson) B.L. Rob. var. *cotyledon*	CaRH removed
Lewisia cotyledon (S. Watson) B.L. Rob. var. *howellii (S. Watson) Jeps.*	CaRH removed
Lilium washingtonianum Kellogg subsp. *washingtonianum*	KR added
Limnanthes alba Hartw. ex Benth. subsp. *versicolor* (Greene) C.T. Mason	KR added
Lithophragma bolanderi A. Gray	KR added
Logfia gallica (L.) Coss. & Germ.	KR added
Lomatium bicolor (S. Watson) J.M. Coult. & Rose var. *leptocarpum* (Torr. & A. Gray) Schlessman	KR added
Lomatium caruifolium (Hook. & Arn.) J.M. Coult. & Rose var. *denticulatum* Jeps.	KR added
Lomatium marginatum (Benth.) J.M. Coult. & Rose var. *marginatum*	CaRH removed
Lonicera involucrata (Richardson) Banks ex Spreng. var. *involucrata*	KR added; CaRH added
Luina hypoleuca Benth.	CaRH removed
Lupinus albifrons Benth. var. *albifrons*	KR added
Lupinus lepidus Douglas ex Lindl. var. *lobbii* (S. Watson) C.L. Hitchc.	KR added; CaRH added
Lychnis coronaria (L.) Desr.	KR added
Marah watsonii (Cogn.) Greene	KR added; CaRH added
Mimulus bolanderi A. Gray	KR added
Monardella breweri A. Gray subsp. *lanceolata* (A. Gray) A.C. Sanders & Elvin	KR added
Monardella odoratissima Benth. subsp. *glauca* (Greene) Epling	KR added
Monardella sheltonii Torr.	KR added
Nemacladus capillaris Greene	KR added; CaRF added
Panicum dichotomiflorum Michx. subsp. *dichotomiflorum*	eKR added; CaRH added
Panicum oligosanthes Schult. var. *scribnerianum* (Nash) Fernald	CaR removed
Parnassia cirrata Piper var. *intermedia* (Rydb.) P.K.Holmgren & N.H. Holmgren	CaRH removed
Pellaea mucronata (*D.C. Eaton*) *D.C. Eaton* var. *mucronata*	KR added
Penstemon azureus Benth. var. *angustissimus* A. Gray	KR added
Penstemon filiformis (D.D. Keck) D.D. Keck	eKR to KR
Penstemon newberryi A. Gray var. *newberryi*	KR added
Penstemon rydbergii A. Nelson var. *oreocharis* (Greene) N.H. Holmgren	KR added
Petrorhagia dubia (Raf.) G. López & Romo	KR added
Poa palustris L.	KR added
Polygonum majus (Meisn.) Piper	KR added
Polystichum munitum (Kaulf.) C. Presl	CaR removed
Potamogeton crispus L.	KR added; CaR added
Ptelea crenulata Greene	eKR added; CaRH added
Quercus douglasii Hook. & Arn.	KR added
Quercus lobata Née	KR added
Quercus wislizeni A. DC. var. *wislizeni*	KR added
Sanicula tuberosa Torr.	KR added
Silene campanulata S. Watson subsp. *glandulosa* C.L. Hitchc. & Maguire	CaR removed
Sparganium natans L.	eKR added
Staphylea bolanderi A. Gray	eKR added
Streptanthus longisiliquus G.L. Clifton & R.E. Buck	eKR added
Symphyotrichum bracteolatum (Nutt.) G.L. Nesom	KR added
Symphyotrichum frondosum (Nutt.) G.L. Nesom	KR added
Tauschia kelloggii (A. Gray) J.F. Macbr.	KR added
Thermopsis gracilis Howell	CaR removed
Trifolium ciliolatum Benth.	KR added
Trillium chloropetalum (Torr.) Howell	KR added
Vaccinium parvifolium Sm.	CaRH removed
Wyethia glabra A. Gray	KR added

TABLE 2. Summary of 141 Jepson manual distribution string changes, classification, and life form for 114 plant taxa occurring in the revised Klamath Ranges Boundary. CaR = Cascade Ranges; CaRF = Cascade Range Foothills; CaRH = High Cascade Range; KR = Klamath Ranges; eKR = Eastern Klamath Range.

Number of	CaR/CaRF/ CaRH added	CaR/CaRF/ CaRH removed	CaR made CaRF	KR added	eKR added	eKR made KR
Taxa	21	32	2	75	10	1
Families	17	16	2	27	9	1
Genera	21	29	2	61	10	1
Grasses/Herbs	16	25	1	64	8	1
Ferns	0	2	0	2	0	0
Vines	1	1	1	1	0	0
Shrubs	4	4	0	5	2	0
Trees	0	0	0	3	0	0

confusion, since most people naturally associate "Shasta" with Mt. Shasta, the prominent volcanic peak in the southern Cascade Ranges. Instead, "Shasta" in reference to eastern KR flora pertains to the geographic location of the eastern KR as almost entirely in western Shasta County and proximal to Shasta Lake, the large reservoir formed by Shasta Dam, which captures the waters of the upper Sacramento, McCloud, and Pit River watersheds.

Several recent events created an opportunity to revisit eastern KR and CaR boundary issues: botanical field surveys associated with environmental impact analyses for several large public land proposals produced an abundance of new plant distribution and ecological data, digitized Consortium of California Herbaria (CCH) records with coordinates now make floristic analysis and quality control of location data much easier, and several new eastern KR endemic taxa have been recently described (Nesom 2013; Huiet et al. 2015; Nelson and Lindstrand 2015; York et al. 2015). The timing seemed appropriate to make long overdue changes to the KR/CaR boundary.

METHODS

Revising the KR boundary required several steps: (1) determine the geographic area where the new boundary occurs, (2) revise the Jepson map to reflect the updated KR and CaR boundaries, (3) update the existing Jepson map geographic subdivision and subregion descriptions for the KR and CaR to reflect the revised boundaries, (4) determine if plant taxa recorded in this area require geographic range updates to their TJM2 distribution string based on the revised boundaries, and (5) make appropriate geographic range updates to those taxa in the Jepson eFlora (Jepson Flora Project 2014).

We determined the area requiring boundary revisions based on our collective experience in the area and existing geology and ecological subregion maps (Irvin 1994; Miles and Goudy 1997). Once identified, a GIS shapefile of the eastern KR adjustment area was created. A list of taxa whose distribution statements would be affected by this change (i.e., taxa whose bioregion statement in the Jepson eFlora contained one or two of KR, CaRH, and CaRF, but not all three) was extracted from the Jepson eFlora, and all georeferenced records of those taxa were extracted from the CCH (2014). Using the QGIS software package (Quantum GIS Development Team 2015), we compared specimen points to bioregion polygons. Any taxon with at least one specimen occurrence in the revised KR boundary would require review. In order to best represent the full ranges of plant taxa, all CCH specimen records were resolved to currently accepted nomenclature according to Jepson eFlora synonymy prior to GIS analysis.

The resulting list of plant taxa was reviewed to determine whether: they occur only within the revised KR boundary polygon and require an update to their distribution string to either remove CaR and add KR; retain CaR and add KR; or retain only the CaR designation depending on their occurrence within and out of the revised boundaries. Taxa limited to the revised KR boundary polygon were given the additional designation of "eKR" to represent their eastern KR distribution. Finally, we made revisions to the geographic subdivision and subregion descriptions by developing narrative text describing the new boundaries based on their new geographic locations, emphasizing the underlying geology that unifies the Cascade Ranges and separates it from the Klamath Ranges.

RESULTS

The revised KR boundary encompasses approximately 232,552 hectares and overlaps portions of the (former) CaR, High Cascade Ranges (CaRH), and Cascade Range Foothills (CaRF) subregions (Fig. 1). Approximately 195,544 hectares of the CaRH and 37,008 hectares of the CaRF subregions are now included in the KR. Two-hundred thirty-two plant taxa with only KR or CaRH/CaRF range descriptions occurred in the revised KR boundary, requiring review of their TJM2 and Jepson eFlora distribution string. This review resulted in 141 range description changes for 114 taxa, including 29 taxa previously incorrectly assigned as CaR, CaRH, or CaRF now

TABLE 3. List of plant taxa reaching their California northern distribution in the revised Klamath Ranges Boundary.

Taxon
Acmispon grandiflorus (Benth.) Brouillet var. *macranthus* (Greene) Brouillet
Adiantum shastense Huiet & A.R. Sm.
Ageratina shastensis (D.W. Taylor & Stebbins) R.M. King & H. Rob.
Anisocarpus scabridus (Eastw.) B.G. Baldwin
Aristolochia californica Torr.
Astragalus pauperculus Greene
Brodiaea californica Lindl.
Brodiaea matsonii R.E. Preston
Calochortus monophyllus (Lindl.) Lem.
Calochortus syntrophus Callahan
Calycanthus occidentalis Hook. & Arn.
Calystegia atriplicifolia Hallier f. subsp. *buttensis* Brummitt
Cephalanthus occidentalis L.
Cirsium occidentale (Nutt.) Jeps. var. *venustum* (Greene) Jeps.
Clarkia amoena (Lehm.) A. Nelson & J.F. Macbr. subsp. *whitneyi* (A. Gray) F.H. Lewis & M.E. Lewis
Clarkia borealis E. Small subsp. *arida* E. Small
Clarkia borealis E. Small subsp. *borealis*
Collinsia tinctoria Hartw. ex Benth.
Cordylanthus pilosus A. Gray subsp. *hansenii* (Ferris) T.I. Chuang & Heckard
Datura wrightii Regel
Delphinium gracilentum Greene
Dendromecon rigida Benth.
Eriophyllum lanatum (Pursh) J. Forbes var. *obovatum* (Greene) H.M. Hall
Erythranthe taylorii G.L. Nesom
Erythronium shastense D.A. York, J.K. Nelson & D.W. Taylor
Fritillaria eastwoodiae R.M. Macfarlane
Galium sparsiflorum W. Wight subsp. *glabrius* Dempster & Stebbins
Hesperevax acaulis (Kellogg) Greene var. *robustior* Morefield
Hoita macrostachya (DC.) Rydb.
Hoita orbicularis (Lindl.) Rydb.
Hosackia stipularis Benth. var. *ottleyi* (Isely) Brouillet
Hosackia stipularis Benth. var. *stipularis*
Hypericum concinnum Benth.
Hypericum mutilum L.
Keckiella breviflora (Lindl.) Straw var. *glabrisepala* (D.D. Keck) N.H. Holmgren
Leptosiphon latisectus (E.G. Buxton) J.M. Porter & L.A. Johnson
Lewisia cantelovii J.T. Howell
Limnanthes alba Hartw. ex Benth. subsp. *alba*
Lomatium caruifolium (Hook. & Arn.) J.M. Coult. & Rose var. *denticulatum* Jeps.
Lomatium marginatum (Benth.) J.M. Coult. & Rose var. *marginatum*
Marah watsonii (Cogn.) Greene
Mimulus bolanderi A. Gray
Monardella breweri A. Gray subsp. *lanceolata* (A. Gray) A.C. Sanders & Elvin
Myriopteris cooperae (D.C. Eaton) Grusz & Windham
Neviusia cliftonii Shevock, Ertter & D.W. Taylor
Odontostomum hartwegii Torr.
Pellaea andromedifolia (Kaulf.) Fée
Penstemon azureus Benth. var. *angustissimus* A. Gray
Phacelia vallicola Congdon ex Brand
Plagiobothrys glyptocarpus (Piper) I.M. Johnst. var. *glyptocarpus*
Ptelea baldwinii Torr. & A. Gray subsp. *crenulata* (Greene) A.E. Murray
Ranunculus canus Benth.
Sedella pumila (Benth.) Britton & Rose
Sedum obtusatum A. Gray subsp. *paradisum* Denton
Selaginella hansenii Hieron.
Sidalcea gigantea G.L. Clifton, R.E. Buck & S.R. Hill
Staphylea bolanderi A. Gray
Streptanthus longisiliquus G.L. Clifton & R.E. Buck
Styrax redivivus (Torr.) L.C. Wheeler
Torreya californica Torr.
Vaccinium shastense J.K. Nelson & Lindstrand subsp. *shastense*
Wyethia glabra A. Gray

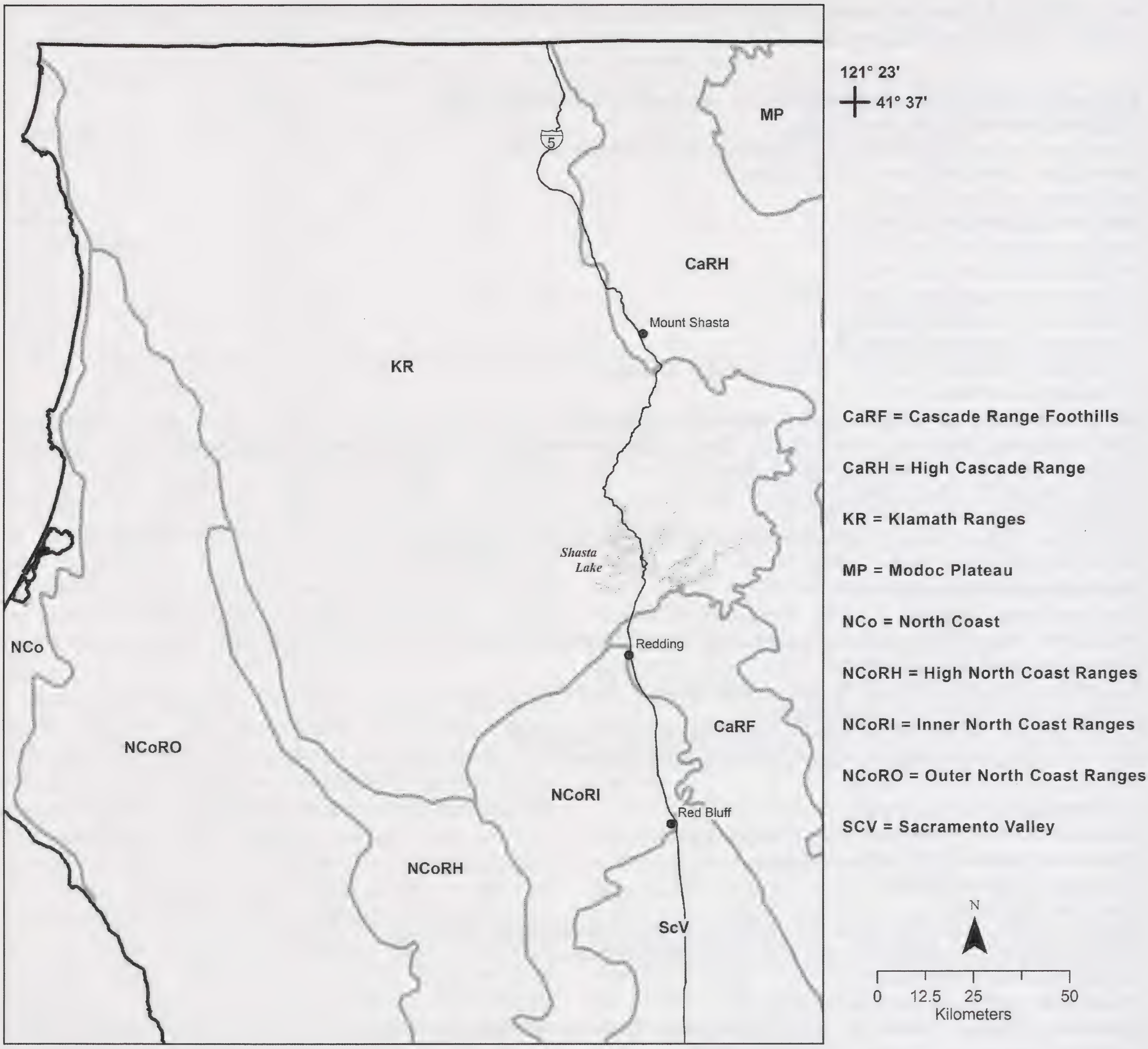

FIG. 2. Revised Klamath Ranges and Cascade Ranges Jepson Map boundaries.

included in KR (Table 1). Eighty-five additional taxa also received some type of range description revision (Table 1), while 118 taxa required no revisions. The 114 taxa subject to distribution string changes overall included 92 genera in 38 families, and consisted of 93 grass/herb, 13 shrub, three fern, two vine, and three tree species. Most changes resulted from the addition of KR to the distribution string of 75 taxa (Table 2).

The geographic range revisions made possible by the new KR boundary and review of CCH records for plant taxa included in the new KR boundary show 62 native plant taxa reach their California northern extent in the eastern KR (Table 3). Analysis of the geographic range revisions and recent species descriptions (Nesom 2013; Huiet et al. 2015; York et al. 2015) also show six taxa are endemic to the eastern KR, including *Ageratina shastensis*, *Brodiaea matsonii* R.E. Preston, *Clarkia borealis* E. Small subsp. *arida* E. Small, *Neviusia cliftonii*, *Erythranthe taylorii* Nesom, and *Erythronium shastense* York et al. Three taxa, *Adiantum shastense* Huiet et al., *Arnica venosa*, and *Clarkia borealis* E. small subsp. *borealis* are near endemics to the eastern KR, as the majority of their distribution occurs in the eastern KR. Additionally, portions of the restricted distribution of KR endemic *Vaccinium shastense* Nelson & Lindstrand subsp. *shastense* occur in the eastern KR (Nelson and Lindstrand 2015).

The new KR boundary (Fig. 2) now encompasses most of the lands east of Interstate 5, south of Highway 89, and north of Highway 299E to include Shasta Lake, the McCloud and Hosselkus limestone formations, and Grizzly Peak, the highest point in the eastern KR at 1905 m (6250 ft) elevation, on the divide between the Pit and McCloud River watersheds. The southern portion of the KR now combines with the northern portions of the Inner North Coast Ranges and Cascade Range Foothills to form a contiguous horseshoe-shaped band of similar vegetation around the head of the Sacramento Valley

(Fig. 2). The new CaR boundary now starts entirely east and south of Shasta Lake and abuts the Inner North Coast Ranges subregion along Interstate 5 from west of Redding south to Red Bluff (Fig. 2).

The new KR boundary, updated CaRH and CaRF subregion boundaries, applicable plant taxa distribution string updates, and revised descriptions for these geographic areas were provided as updates and incorporated into the Jepson eFlora (http://ucjeps.berkeley.edu/eflora/), CCH (http://ucjeps.berkeley.edu/consortium/), and Jepson Online Interchange (http://ucjeps.berkeley.edu/interchange/) during September 2015.

DISCUSSION

The revised KR boundary now provides a far more accurate representation of the ecological and geologic attributes of this unique area. The new boundary also better portrays the distribution of many taxa that reach their northernmost California limits in the eastern KR and the occurrence of several endemic or near endemic taxa. This revised boundary and the associated descriptions are also congruent with other established geologic and geographic classification systems (e.g., Irvin 1994; Miles and Goudy 1997), reducing potential confusion when conducting various natural resource analyses in the eastern KR.

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